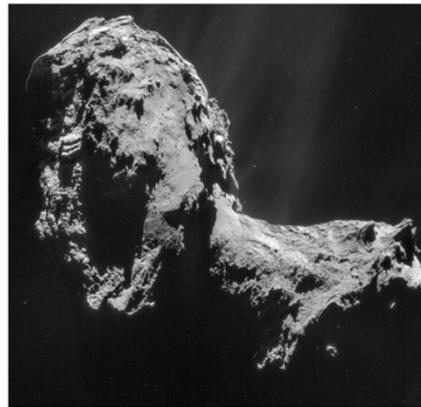
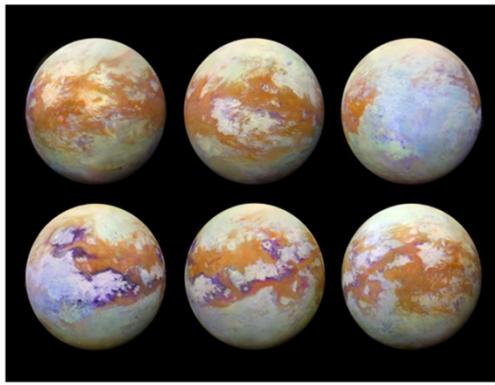


ASTRONOMY LAB PROJECT – SOLAR SYSTEM MISSIONS AND SPACECRAFT

*Projects and presentations due last week
of lab*



PROJECT INTRODUCTION

Astronomy gives us glimpses of worlds beyond our own. In your Astronomy lecture, you have learned about different missions and spacecraft that have furthered the field of Astronomy, transporting scientists and the public alike outside of our Earth revealing answers to questions about the Universe in which we reside. In your Astronomy Lab Project, you will study one of these missions or spacecraft in-depth.

SELECTIONS AND PRESENTATION DETAILS

For your final project for Astronomy lab, you will craft both an individual project and also a 10-minute group slideshow presentation on a Solar System mission or spacecraft of your choice selected from a list of options. You will have two decisions to make before preparing this project and presentation: your group must first decide on this **Mission/Spacecraft Selection** to research (examples: New Horizons, Curiosity, or Voyager 1; see pages 8-17 for all selection options), and second you must decide on a project **Format Selection**, the method that you prefer to use to convey the results of your research for your project, also chosen from a list of options (examples: blog, video, or paper; see page 6 for selection option details). You will submit your project to your TA at the beginning of class the last week of lab, and you will also give a 10-minute group slideshow presentation this same week. 5 minutes will also be set aside for questions (not included in the 10 minutes). For this presentation, use an application such as PowerPoint or Prezi. Your slideshow should be created using best presentation formatting (most slides should contain both images and text, you should use bullet points rather than long lengthy paragraphs, you should have introduction and conclusion slides, etc.) Each student in your group should talk for at least 2 minutes. During the lab period, each member of your group is responsible for asking another group a question about their project (3 questions total for your group).

PROJECT CONTENT

Once your group has picked your group Mission/Spacecraft Selection, your job is to study the mission or spacecraft in detail. Your individual project and group project presentation must include enough information to write a 2-page, double-spaced paper (you don't need to write this paper (unless you choose the paper Format Selection), you just need to incorporate this much material into your blog or video, etc.) This information must address the following:

Background

What is your Mission/Spacecraft Selection? What tools (instruments) did/does it use to collect data and perform science? Who built the mission or spacecraft and its instruments? How was it funded? What is the historical timeline for this mission (When was the idea for it conceived? When was it built? When was it launched/when did it first begin operating? Have there been any other events of note?) What is the current operational status of this mission or spacecraft?

Science of the Mission or Spacecraft

What astronomical objects were/are studied by this mission or spacecraft? What are the scientific goals of this program? What form does the data collected take? What have scientists learned from this data?

Conclusion

Were the program goals achieved? What questions remain unanswered by this mission or spacecraft, at least so far, and what new questions were developed because of the program? What remains to be uncovered by other similar programs? Are there plans for any similar programs on the horizon?

On the Mission/Spacecraft Selection page you choose (pages 8-17), this **selection text may share additional items or questions to address**; if it does, make sure to include information to answer these questions. Finally, in the format of your choice, also include in your project **a list of citations** you used for researching your mission or spacecraft. You must include at least 3 sources. Every Mission/Spacecraft Selection page (pages 8-17) includes one or more suggested resources for getting started. You are welcome to use these resources as part or all of your 3 citations, though this is not required. The members of your group may use the same citations in your individual projects.

PROJECT GRADING AND SCHEDULE

This final project will be worth 60 points of the total points that make up your total lab grade, or the equivalent of 3 individual lab grades. The rubrics that will be used to grade the two parts of your final project, your individual project and your group presentation, can be found on pages 4-5. Your individual project and group presentation are due the last week of lab.

PROJECT RUBRIC

40/60 points of project grade

Category / Score	3	8	13	Score and Notes
Mission/Spacecraft Selection Science	<ul style="list-style-type: none"> It was not clear which Mission/Spacecraft Selection was made The group does not address the astronomical objects studied by the Mission/Spacecraft, its scientific goals, what was learned from the Mission/Spacecraft, if the program goals were achieved, and what remains to be uncovered by future programs 	<ul style="list-style-type: none"> The group addresses some but not all of the following: the astronomical objects studied by the Mission/Spacecraft, its scientific goals, what was learned from the Mission/Spacecraft, if the program goals were achieved, and what remains to be uncovered by future programs 	<ul style="list-style-type: none"> It was clear which Mission/Spacecraft Selection was made The group addresses the astronomical objects studied by the Mission/Spacecraft, its scientific goals, what was learned from the Mission/Spacecraft, if the program goals were achieved, and what remains to be uncovered by future programs 	
Mission/Spacecraft Background, Conclusion, and Other Topics	<ul style="list-style-type: none"> Use of scientific language is routinely incorrect The does not address the Mission/Spacecraft's instruments, who built it/ them, launch/first light information and other key dates, or current operational status of the Mission/Spacecraft If the student's individual Mission/Spacecraft Selection page gives additional items or questions to address, the student does not include this information 	<ul style="list-style-type: none"> Use of scientific language is usually correct but infrequently incorrect, and sometimes clunky/awkward The group addresses some but not all of the following: the Mission/Spacecraft's instruments, who built it/ them, launch/first light information and other key dates, and current operational status of the Mission/Spacecraft If the student's individual Mission/Spacecraft Selection page gives additional items or questions to address, the student includes some but not all of this information 	<ul style="list-style-type: none"> Use of scientific language is appropriate The group addresses the Mission/Spacecraft's instruments, who built it/ them, launch/first light information and other key dates, and current operational status of the Mission/Spacecraft If the student's individual Mission/Spacecraft Selection page gives additional items or questions to address, the student includes this information 	
Format Selection Organization	<ul style="list-style-type: none"> It was not clear which Format Selection was made Includes 1 or no citations supporting information Spelling & grammar mistakes in every sentence Very little information is included in the report The student has put little effort into the creation of their website/video/paper 	<ul style="list-style-type: none"> Includes only 2 citations supporting information Average number of spelling & grammar mistakes The report includes information, but it is not enough information to use to write a 2-page paper The student has put some effort into making their project engaging and interesting 	<ul style="list-style-type: none"> It was clear which Format Selection was made Includes 3 or more citations supporting information No noticeable spelling & grammar mistakes The report clearly includes a sufficient amount of information to fill a 2-page, double-spaced paper The student has put good effort into making their website/video/paper engaging, making creative choices where applicable 	
Initial Score				
Final Score (Initial Score + 1)				

PRESENTATION RUBRIC

20/60 points of project grade

Category / Score	0	2.5	5	Score and Notes
Mission/Spacecraft Selection Science	<ul style="list-style-type: none"> It was not clear which Mission/Spacecraft Selection was made The group does not address the astronomical objects studied by the Mission/Spacecraft, its scientific goals, what was learned from the Mission/Spacecraft, if the program goals were achieved, or what remains to be uncovered by future programs 	<ul style="list-style-type: none"> The group addresses some but not all of the following: the astronomical objects studied by the Mission/Spacecraft, its scientific goals, what was learned from the Mission/Spacecraft, if the program goals were achieved, and what remains to be uncovered by future programs 	<ul style="list-style-type: none"> It was clear which Mission/Spacecraft Selection was made The group addresses the astronomical objects studied by the Mission/Spacecraft, its scientific goals, what was learned from the Mission/Spacecraft, if the program goals were achieved, and what remains to be uncovered by future programs 	
Mission/Spacecraft Background, Conclusion, and Other Topics	<ul style="list-style-type: none"> Use of scientific language is routinely incorrect The does not address the Mission/Spacecraft's instruments, who built it/ them, launch/first light information and other key dates, or current operational status of the Mission/Spacecraft If the group's individual Mission/Spacecraft Selection page gives additional items or questions to address, the group does not include this information 	<ul style="list-style-type: none"> Use of scientific language is usually correct but infrequently incorrect, and sometimes clunky/awkward The group addresses some but not all of the following: the Mission/Spacecraft's instruments, who built it/ them, launch/first light information and other key dates, and current operational status of the Mission/Spacecraft If the group's individual Mission/Spacecraft Selection page gives additional items or questions to address, the group includes some but not all of this information 	<ul style="list-style-type: none"> Use of scientific language is appropriate The group addresses the Mission/Spacecraft's instruments, who built it/ them, launch/first light information and other key dates, and current operational status of the Mission/Spacecraft If the group's individual Mission/Spacecraft Selection page gives additional items or questions to address, the group includes this information 	
Presentation Organization	<ul style="list-style-type: none"> Includes 1 or no citations supporting information Spelling & grammar mistakes in every slide The group has put little effort into the creation of their presentation Presentation is noticeably short Presentation is very difficult to read and has the incorrect amount of text and to the extreme If asked questions, students did not respond to questions asked 	<ul style="list-style-type: none"> Includes only 2 citations supporting information Average number of spelling & grammar mistakes The group has put some effort into making their presentation engaging and interesting Slides are mostly easy to read with an appropriate amount of text (not too wordy) If asked questions, students' responses could benefit from more professionalism 	<ul style="list-style-type: none"> Includes 3 or more citations supporting information No noticeable spelling & grammar mistakes The group has put good effort into making their presentation engaging, making creative choices where applicable Slides are easy to read with an appropriate amount of text (not too wordy) Students attempted to answer questions thoughtfully and professionally 	
Category / Score	0	1.5	2.5	Score and Notes
Questions	<ul style="list-style-type: none"> Group poses 1 or no questions, or only 2 or 3 questions all asked by the same student 	<ul style="list-style-type: none"> 2 group members pose a relevant question during another presentation 	<ul style="list-style-type: none"> All 3 group members pose a relevant question during a another presentation 	
Individual Score	<ul style="list-style-type: none"> Little to no fluid delivery, appropriate vocal enthusiasm and audience engagement (gestures, etc.) Student read directly from the slides, did not speak at all, or was absent 	<ul style="list-style-type: none"> Some fluid delivery, appropriate vocal enthusiasm and audience engagement (gestures, etc.) Student spoke for at least 1 minute 	<ul style="list-style-type: none"> Fluid delivery, appropriate vocal enthusiasm and audience engagement (gestures, etc.) Student presented 1 image and spoke for at least 2 minutes 	
Final Score				

FORMAT SELECTIONS

Choose one. Regardless of format, include material equivalent to the amount of information in a 2-page, double-spaced paper. Address all questions; don't forget to list 3 resources.

VIDEO

Convey your research through video format. Show visuals highlighting your mission or spacecraft, and dub in or film yourself narrating. This audio-visual format can also be used to showcase a more creative endeavor (though it is not required): You could choose to write and perform a song about your mission or spacecraft, or a poem, etc.

POSTER

Display informational text and visuals for your mission or spacecraft all in a single, visually organized location. Provide your TA with a copy of this digital poster or a high-quality photograph of this physical poster where all words are legible. Transcribe your text if this is not possible.

BLOG/WEBSITE

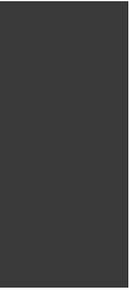
Showcase your mission or spacecraft providing information and introduction in this visual medium. Provide your TA with the link to the blog or website you create for your project.

PAPER

Write a paper to get your information across. It should be 2-pages, double-spaced, 12-point font, 1-inch margins, etc. Your list of citations do not count toward the page length.

OTHER FORMAT

If you have an idea for another format, you must approve it with your TA. It's likely to get approved, but you'll need to formally check on this.

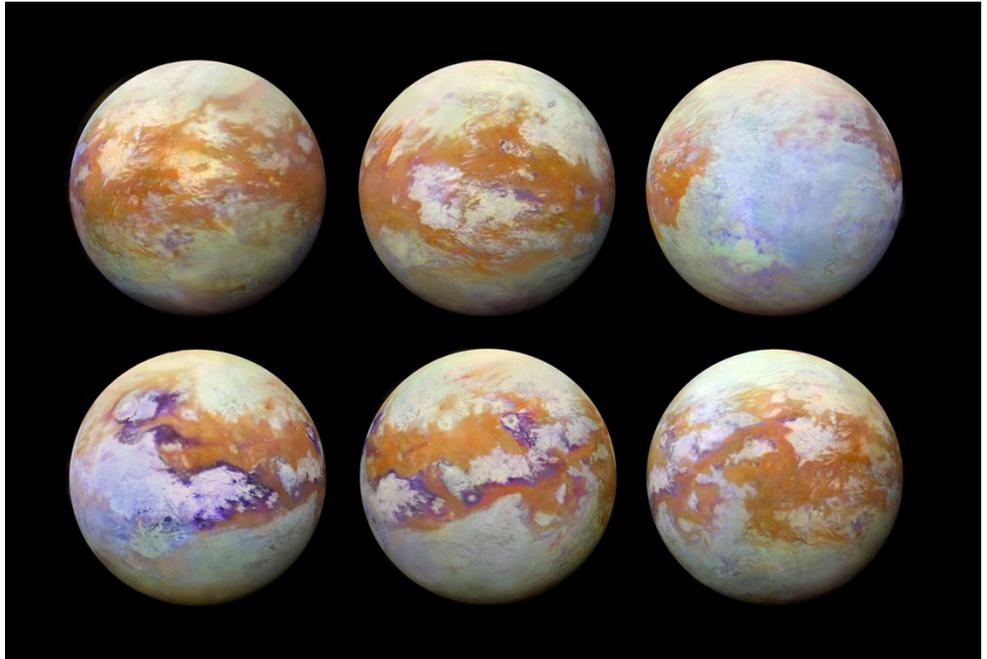


MISSION/SPACECRAFT SELECTIONS

Choose one from pages 8-17

CASSINI MISSION

Cassini: one of NASA's most ambitious and successful missions. Originally launched in 1997, the probe reached Saturn in late 2004 where it stayed in orbit to study the planet (and its rings and moons) for 13 years. While usually referred to as just Cassini, this mission is officially named Cassini-Huygens and was a collaborative project between NASA, the European Space Agency, and the Italian Space Agency. The European contribution to the project was the Huygens Lander, which was successfully landed on Saturn's moon Titan. These two probes, together, gave us detailed information about one of the most exciting moons in the Solar System; a global image that Cassini took in infrared is given



below. The most ambitious results that Cassini gave us, though, came in its decommissioning. To remove the possibility of Earth life contaminating the moons of Saturn, Cassini's orbit was changed so it fell into Saturn, taking images all while falling in.

Get started here:

The NASA mission page for Cassini is an excellent location to find Cassini's photos of the Saturn system. Not all of the images in the gallery are actual photos the probe took, but reading the caption on an image you are interested in will reveal if it is.

https://www.nasa.gov/mission_pages/cassini/images/index.html

If you would rather be able to filter your image search beforehand, then NASA's solar system website's page on Cassini is what you are after.

[https://solarsystem.nasa.gov/missions/cassini/galleries/images/?page=0&per_page=25&order=created_at+desc&search=&tags=cassini&condition_1=1%3Ais in resource list&category=51/](https://solarsystem.nasa.gov/missions/cassini/galleries/images/?page=0&per_page=25&order=created_at+desc&search=&tags=cassini&condition_1=1%3Ais%20in%20resource%20list&category=51/)

NEW HORIZONS SPACECRAFT

New Horizons is a NASA spacecraft that studied Pluto and is currently on its way to study deeper in the Kuiper Belt, a region of dwarf planets and other small, icy bodies well outside of Neptune's orbit. The primary goal is to learn how Pluto and other Kuiper belt objects fit in with the eight planets that we have been able to study more extensively, as well as to get the first up close images of Pluto.



Get started here:

https://www.nasa.gov/mission_pages/newhorizons/overview/index.html

— this is NASA's main New Horizons page which will help you learn more about the mission and its goals

https://www.nasa.gov/mission_pages/newhorizons/images/index.html —

this has hundreds of amazing pictures, including the one above. If you see a cool image elsewhere, it probably came from here originally

<https://www.space.com/18377-new-horizons.html> — this has another nice overview of the mission. Also if you go to the "Pluto encounter" section, you'll see an example of how they were able to make a scientific discovery off of images they took

<https://www.space.com/new-horizons-observations-continue-in-kuiper-belt.html>

— this article has more details about the current phase of the mission in the Kuiper Belt specifically

<https://solarsystem.nasa.gov/news/860/new-horizons-spacecraft-returns-its-sharpest-views-of-ultima-thule/> —

this is a news article about one of the goals they were able to accomplish more recently and what they found, with some cool images and a video

JUNO SPACECRAFT

Juno is a NASA spacecraft that is currently orbiting Jupiter. It's studying Jupiter, especially its atmosphere and magnetic field, with the ultimate goal of learning more about how Jupiter formed and has evolved.



Get started here:

https://www.nasa.gov/mission_pages/juno/overview/index.html — this is NASA's main Juno page which will help you learn more about the mission and its goals

https://www.nasa.gov/mission_pages/juno/images/index.html — this has hundreds of amazing pictures, including the one above. If you see a cool image elsewhere, it probably came from here originally

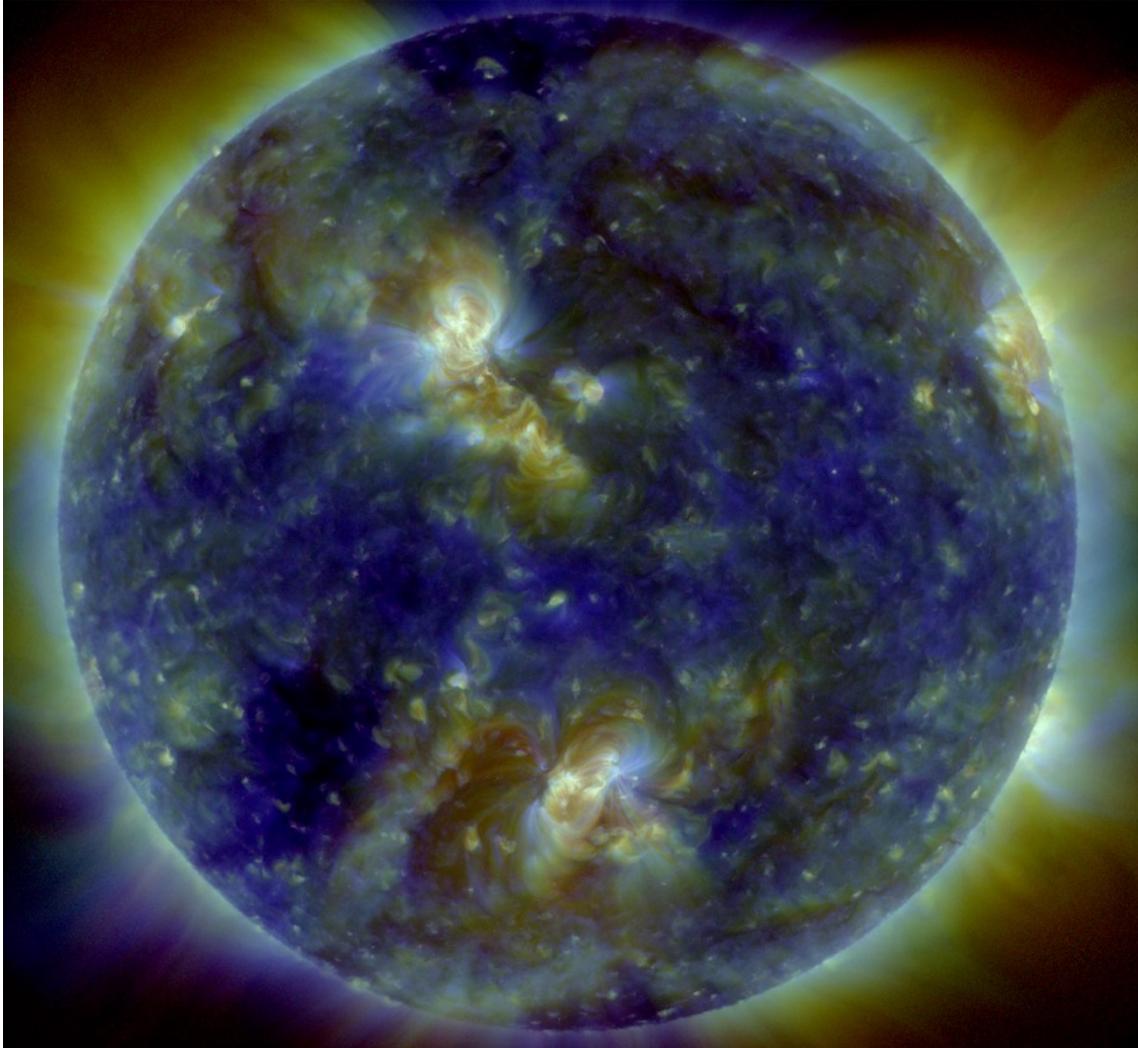
<https://www.space.com/juno-finds-jupiter-water-mystery.html> — this article is about one of the most recent (and surprising) findings of the mission

<https://scitechdaily.com/juno-mission-discovers-astonishing-features-unlike-anything-else-in-our-solar-system/> — this article (as well as similar ones on the same website if you just click the Juno link on topics at the top of the article) is a news story about a specific Juno result from one of the images it took

<https://www.space.com/32742-juno-spacecraft.html> — this article provides a nice overview of the mission

SOLAR DYNAMICS OBSERVATORY

SDO launched in 2010 with the mission to of understanding the interactions between the Sun and the Earth.

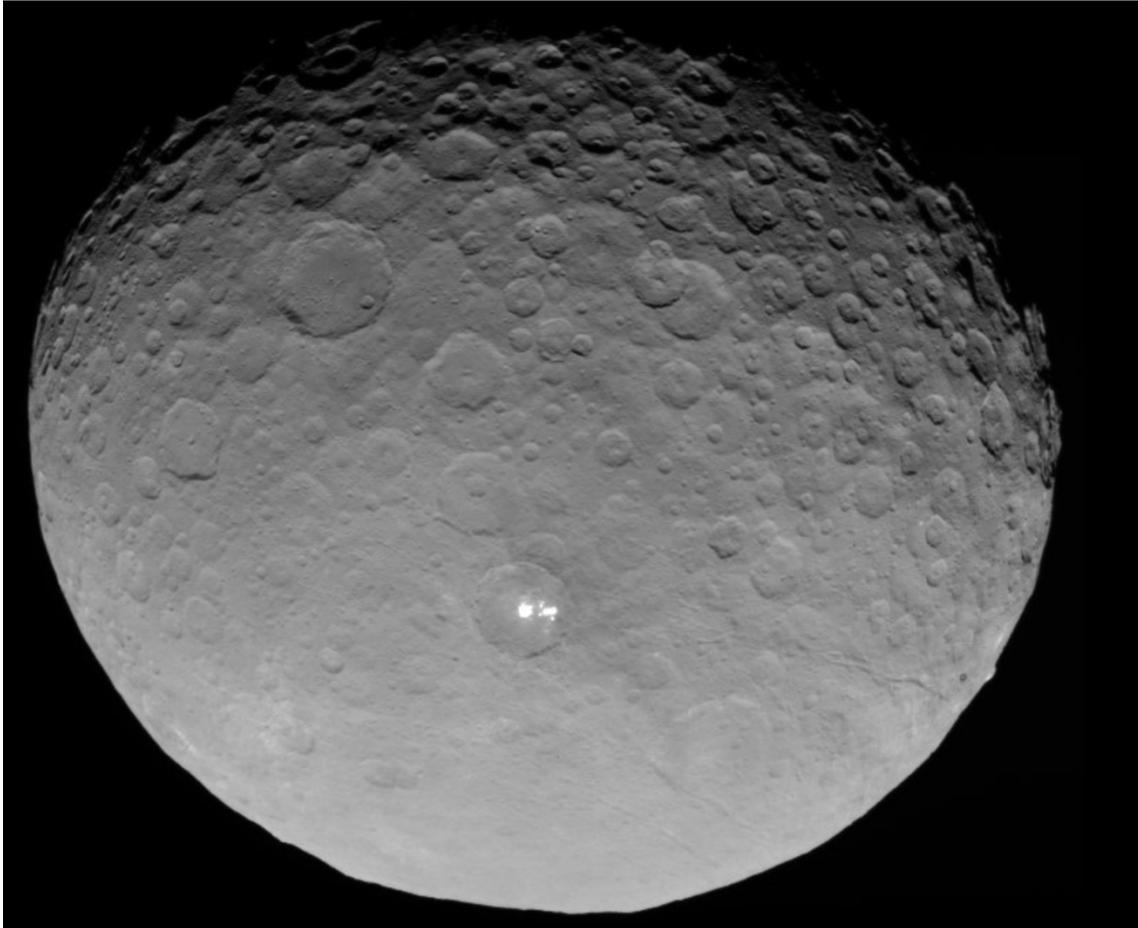


Get started here:

<https://sdo.gsfc.nasa.gov>

THE DAWN SPACECRAFT

Dawn launched in 2007 with the mission to study the asteroid belt (including Ceres, seen below) and the early Solar System.

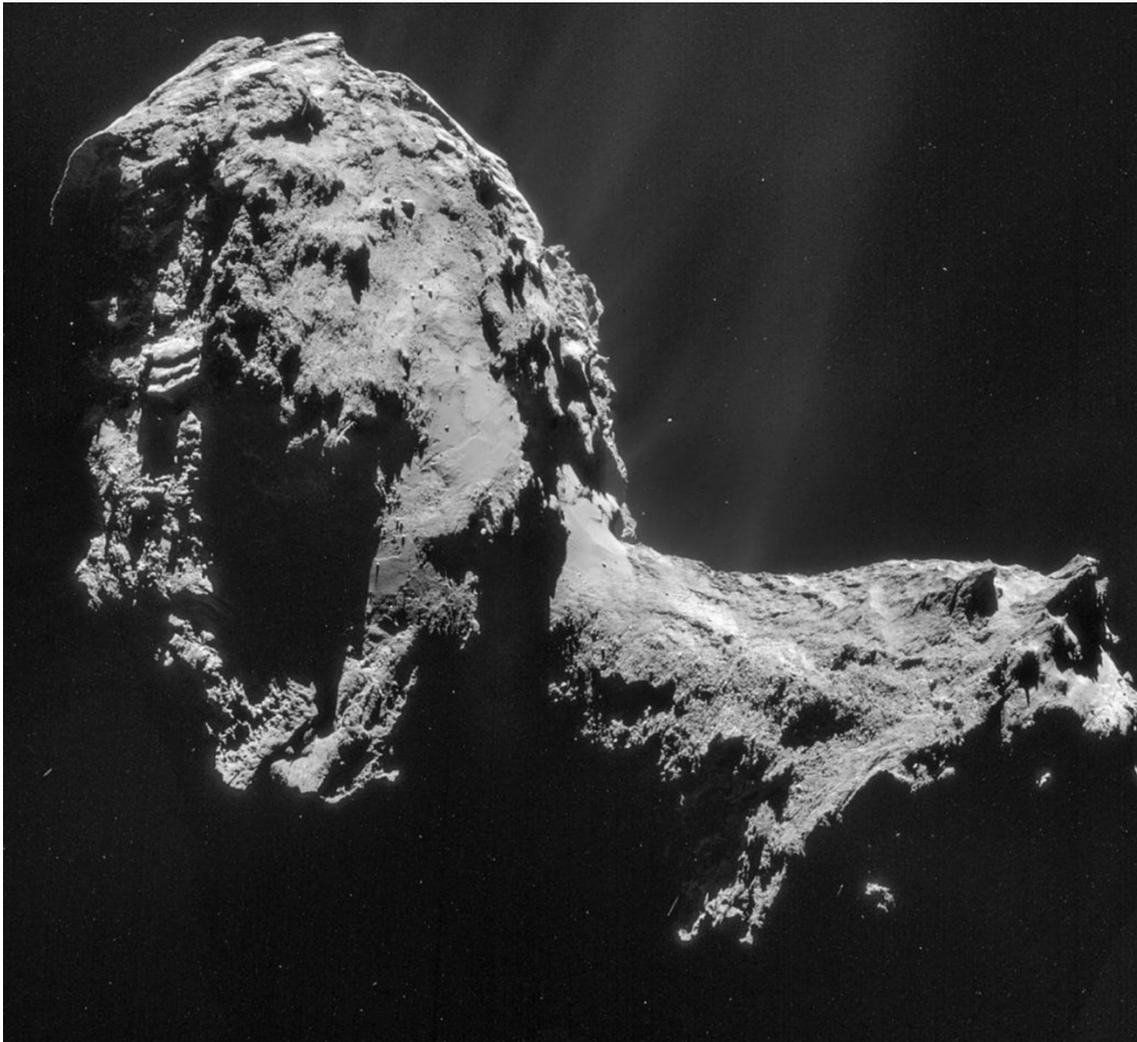


Get started here:

https://www.nasa.gov/mission_pages/dawn/main/index.html

ROSETTA SPACECRAFT AND PHILAE LANDER

Rosetta launched in 2004 with the mission to improve our understanding of the early Solar System. It traveled to study the comet 67P/Churyumov-Gerasimenko (pictured below)



Get started here:

<https://www.nasa.gov/rosetta>

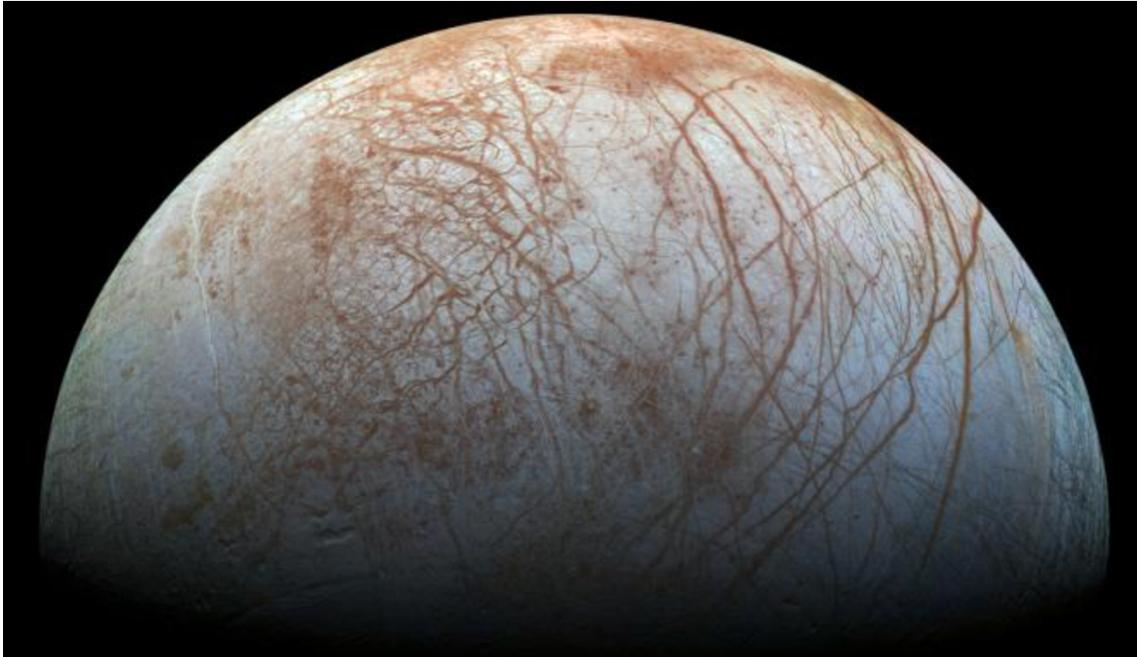
Information to include:

Tell the story of this mission, from conception to inception to completion

How did the spacecraft reach its destination, and how did it operate?

GALILEO SPACECRAFT

Galileo launched in 1989 with the mission of orbiting Jupiter to study the planet and its moons (such as Europa, pictured below)



Get started here:

<https://solarsystem.nasa.gov/missions/galileo/overview/>

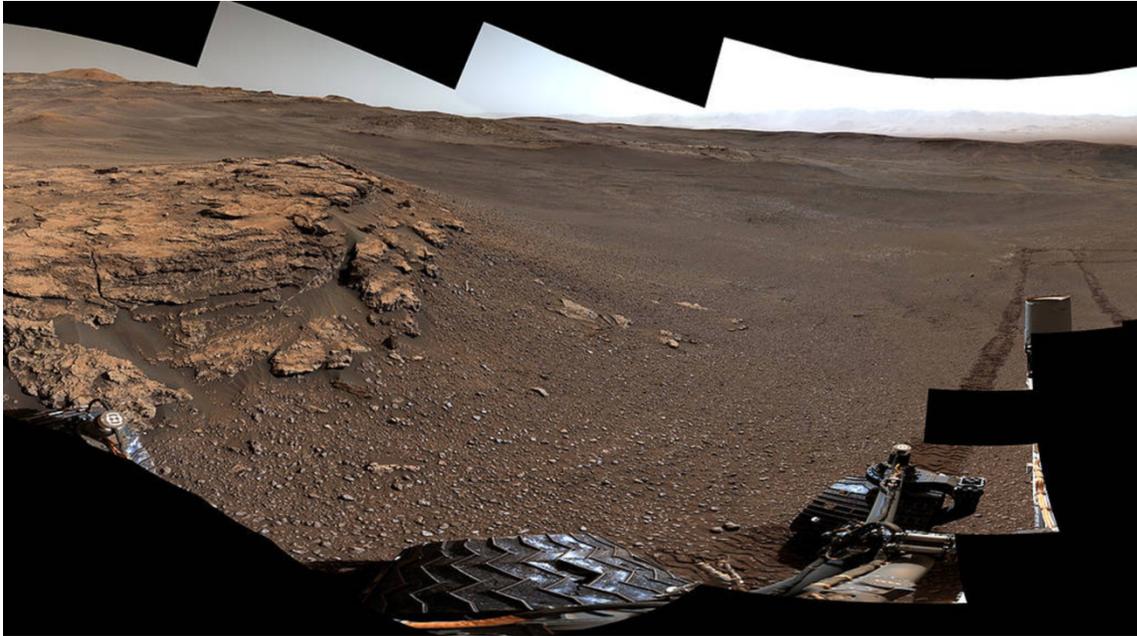
Information to include:

Tell the story of this mission, from conception to inception to completion

How did the spacecraft reach its destination, and how did it operate?

CURIOSITY ROVER

Curiosity launched in 2011 with the mission of investigating conditions for life on Mars (pictured below), both past and present



Get started here:

https://www.nasa.gov/mission_pages/msl/index.html

Information to include:

Tell the story of this mission, from conception to inception to completion

How did the spacecraft reach its destination, and how did it operate?

VOYAGER 1 OR 2

Voyager 1 and 2 launched in 1977 to study the outer Solar System (such as Jupiter's moon Ganymede, seen below) and interstellar space.

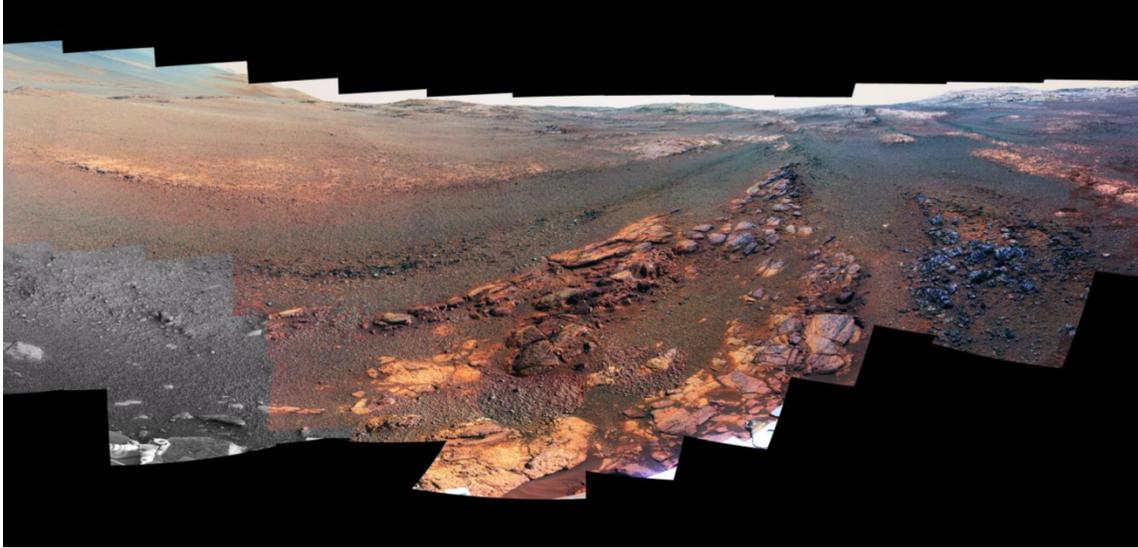


Get started here:

<https://voyager.jpl.nasa.gov>

SPRINT OR OPPORTUNITY

Sprint and Opportunity launched in 2006 to study the surface of Mars.



Get started here:

<https://mars.nasa.gov/mer/>